

## THE BRITISH CALIBRATION SERVICE

### Introduction

1 The British Calibration Service was established by the Government in response to the need expressed by British industry for a comprehensive service for the calibration of instruments against recognized standards. The announcement of the establishment of the Service included:

The state of measurement science and practice in a country is one of the surest signs of its technical efficiency. Modern industrial technology depends on accurate measurement. The country requires both a comprehensive system of national standards of measurement, tied to the recognized international standards, and also facilities for checking, or calibrating, measuring instruments and other test gear against such standards so that their accuracy can be authenticated.

2 Key points of the scheme for establishing the BCS were that the calibration work would be carried out in existing laboratories especially approved for the purpose, and that the Service would be planned and regulated by a headquarters in a Government Department.

3 An Advisory Council on Calibration and Measurement was set up to advise on the operation of the BCS and particularly on the requirements which laboratories must meet in order to be approved.

### BCS approved laboratories

4 In the BCS scheme the term *laboratory* implies any measurement facility that is properly organized, equipped and staffed.

5 Calibration work authenticated under the BCS scheme is carried out in existing laboratories. It is not intended that new Government laboratories be set up for this purpose. Any laboratory may apply for BCS approval, whether the laboratory be in industry, in a research organization, or in a university or other academic institution, and regardless of whether it is financed privately or publicly. Overseas laboratories can qualify for approval under the scheme.

6 A laboratory is approved to carry out specified types of measurement only after thorough investigation. It is asked to state for which types and ranges of measurement it is seeking approval, and for what accuracy of measurement in each case. The scope of the approval can be extended later if further types or ranges of measurement, or improved accuracy, are offered.

7 A BCS approved laboratory provides a record of work done under the BCS scheme on an official BCS certificate. Such a certificate carries the BCS badge and the name of the laboratory. Calibration labels bearing the BCS badge can be affixed to the calibrated instrument. Authorization to use the BCS badge is granted only to BCS approved laboratories.

8 It is normally expected that an approved laboratory will provide a calibration service to customers outside its own organization so as to assist in meeting the national requirements for authenticated calibration. However, it is recognized that this may not be possible in every case.

9 A BCS approved laboratory provides an authenticated calibration service to its customers on a commercial basis. There is no BCS standard scale of charges for calibration work.

#### BCS headquarters

10 BCS headquarters, established originally in the Ministry of Technology, is now in the Department of Industry and is incorporated in the National Physical Laboratory.

11 The BCS headquarters staff is mainly professional. It is responsible for dealing with applications for approval, and subsequently for supervising the operations of laboratories which are approved to ensure that the requirements for approval continue to be met.

12 BCS headquarters makes charges to laboratories to cover the costs of the functions it performs. The charges to any one laboratory are related to the actual costs of investigation and supervision and to the amount of calibration work carried out by the laboratory.

#### The Advisory Council on Calibration and Measurement

13 The Advisory Council on Calibration and Measurement has the following terms of reference:

To advise the Secretary of State on the operation of the national calibration service, on the effective use of the country's calibration and measurement resources, and on the promotion of international collaboration in this field.

14 The Advisory Council first met in November 1966. The Chairman at present is Mr Richard Foxwell, CBE. The Council's membership includes senior people from industry, academic life and the Government service. Each member is appointed in a personal capacity.

15 The Advisory Council agreed at its first meeting to set up Technical Panels to be concerned with specified fields of measurement. The terms of reference of these Panels are:

To examine and report to the Council on the technical aspects and the operation of the national calibration service for the classes of measurement allotted to the Panel, and on such other subjects as the Council may deem to be relevant to the calibration service; also to take an active part in the operation and other associated activities of the calibration service by specifying technical requirements and by contributing or proposing members for assessment teams.

16 The Technical Panels so far appointed are concerned with the following fields of measurement:

- Panel 1: Electrical measurements at dc and low frequencies
- Panel 2: Electrical measurements at high frequencies
- Panel 3: Mechanical and optical measurements
- Panel 4: Measurements on fluids
- Panel 6: Thermal measurements including thermal conductivity
- Panel 7: Radiological measurements.

The Chairman of each Technical Panel is usually appointed a member of the Advisory Council. Panel members are appointed in a personal capacity as experts in their field.

17 The views and recommendations of the Advisory Council are sought on the procedures by which the BCS is operated, and on policy matters and organizational problems which may arise. The Technical Panels have established technical criteria for the approval of laboratories undertaking a wide range of measurements in each of their respective fields. Criteria for further types of measurement are produced as the need arises. Members of the Panels join BCS headquarters staff in the assessment of laboratories seeking approval and in the subsequent supervision of their activities.

#### Traceability of BCS calibrations to national standards of measurement

18 The calibration work carried out by a BCS approved laboratory is authenticated in relation to the quality of the staff and of the equipment and procedures employed and to the validity of the laboratory's calibration standards. The latter aspect requires that there be an approved system for checking the calibration standards against others of higher quality, and that these higher standards be linked in a known way with the appropriate national and international standards of measurement. This is the concept of traceability.

19. As the term *traceability* has sometimes been used to convey slightly different meanings, it is desirable to define exactly what is meant in the BCS use of the term.

#### Traceability to national standards means

- (a) that each standard used for calibration purposes has itself been calibrated against a standard of higher quality up to the level at which the higher quality instrument is the accepted national standard; this is usually a unique item held in a national standards laboratory, but could in some cases be a local standard of equivalent quality built and operated to a national specification and confirmed as operating to that specification;
- (b) that the frequency of such calibration, which is dependent on the type, quality, stability, use and environment of the lower quality standard, is such as to establish reasonable confidence that its value will not move outside the limits of its specification between successive calibrations;
- (c) that the calibration of any instrument against a standard is valid in exact terms only at the time of calibration and its performance thereafter must be inferred from a knowledge of the factors mentioned in (b) above.

20 It is an essential aspect of the approval of a BCS laboratory that its reference standards be traceable to the appropriate national standards. They will normally be checked under approved conditions against standards of the next higher level of quality. Arrangements have been made for the provision of facilities whereby the highest quality reference standards can be checked against the accepted national standards for the fields in which the BCS is operating. Co-operation is maintained with the National Physical Laboratory and other national laboratories at which these facilities are provided.

21 In many cases, where the accuracy required is beyond the capability of other laboratories, approved laboratories send their reference standards direct to the National Physical Laboratory (NPL) for calibration against the national standards. Two BCS approved laboratories hold national standards of derived quantities, directly traceable to the NPL standards of mass, length and time. These are the National Engineering Laboratory (NEL), which holds the national standards for fluid flow measurement and the Aeronautical Quality Assurance Directorate (AQD) which holds the national standard

for the calibration of accelerometers. Traceability for the appropriate reference standards of other laboratories may be provided by calibration at NEL or AQD. The Electrical Quality Assurance Directorate (EQD) acts as Master Reference Laboratory for BCS in the field of rf and microwave measurements. It holds reference standards of the highest quality in this field which are calibrated directly against the national standards of these quantities at NPL and the Royal Signals and Radar Establishment (RSRE). Calibration at EQD is the normal route for traceability in this field.

#### **BCS publications**

22 The details of laboratory approval criteria and procedure, of the conditions for operating an approved laboratory, and of other related matters are set out in a series of publications issued by BCS headquarters. This series includes technical papers on measuring techniques and reference information. A list of publications is available on request.

23 The details of the approvals granted are also published. The BCS Directory of Approved Laboratories gives full information on the types of measurement, and the accuracy in each case, for which the approval has been granted.

Further information is available on request to the headquarters of the BCS:

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